

Biodiversity offsets: Lessons from the American experience

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ABSTRACT

The New South Wales *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006* was implemented to formalise the concept of biodiversity offsets. Its underpinning focus is to allow development in rapidly urbanising areas of the Sydney region and the coastal ribbon of New South Wales. Under defined circumstances biodiversity impacts due to urban development may be offset elsewhere, often in rural areas, where equivalent biodiversity values are identified. This legislation was modelled on the United States of America (US) wetland mitigation banking approach. I investigated some of the pitfalls of the US experience that should have been considered in the implementation of the New South Wales legislation and conclude that most issues appear to be associated with the narrowness of concepts around biodiversity, deficiencies in compliance, and long term monitoring and management of the offset ecosystems.

Key words: mitigation banks, urban biodiversity, habitat loss, threatened species protection, compensatory habitat, environmental compliance, offsets, BioBanking

Introduction

With an expanding world population and the associated on-going loss of biodiversity, new approaches (or the strengthening of current practice) that potentially reduce the rate of extinction of native ecosystems and their biota are critical. The New South Wales (NSW) government introduced the *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006* (<http://www.parliament.nsw.gov.au/>) to add to the suite of legislation that aims to strengthen the conservation of threatened habitats and species. This legislation formalises the concept of biodiversity offsets with a particular focus on offsetting biodiversity loss in the rapidly urbanising areas of Western Sydney and the coastal ribbon developments of the NSW coastline. Biodiversity impacts in these urbanising areas may be offset in non-urban areas with equivalent biodiversity values and where they are better able to maintain viable representation of biodiversity (DECC 2007).

The concept of mitigation banking, albeit for wetlands, was first formalised in legislation in the United States of America (US) under the *Clean Waters Act 1972*. Subsequently there has been a diversity of additional regulation by local, state and federal US authorities together with judicial interpretations associated with the regulation of wetlands (Barkmann and Windhorst 2000). Recently there has been an amendment to the legislation (*Clean Waters Act 2008 [CWA]*) aimed at reducing the legislative tangle, and this has also broadened the concept of mitigation banking to include ecosystem services (see Section 404 *Compensatory Mitigation Program*, CWA).

Since the introduction of wetland mitigation offsets in the US they have increasingly been embraced by industry (including mining, construction, oil and gas, forestry), governments and investors (ICMM 2005), and the concept has now expanded to become a global

phenomenon. In numerous countries Brazil, Canada, and many countries with Europe (ten Kate *et al.* 2004), including Australia (e.g., BioBanking legislation), this approach to negotiating the environmental impacts of development has now been incorporated into the legal framework (ten Kate *et al.* 2004). Demonstration projects have also been widely implemented (e.g., Business and Biodiversity Offset Program pilots/case studies in Washington, Ghana, Mexico, Qatar, South Africa and Uganda - Washington Biodiversity Project 2006; Australia - DEC 2006). Despite this apparent on-going commitment to nature conservation, the evidence of the economic benefits that are derived from such conservation (e.g., aesthetics, cultural necessity, ecological services, climate regulation, harvest of plants and animals; Balmford *et al.* 2002), drivers such as the *Millennium Development Goals* that arose out of the World Summit on Sustainable Development in 2002, and the *Convention on Biological Diversity Decision VI/26* (WSSD 2002; Banana 2005), the loss of species and the degradation of habitats continues unabated (Balmford *et al.* 2002). In the US, where the focus of the legislation is on the mitigation of wetland habitats, controversy over the effectiveness of the outcomes continues. There is substantial evidence of failure to meet agreed mitigation standards (NRC 2001; Sudol and Ambrose 2002; Kihslinger 2008), and disquiet about the offset frequently being developed in a different area to the conservation loss with, at best, limited connection to the habitat lost to development (Ruhl and Salzam 2006).

With increasing pressure from urbanisation on the agricultural lands and remnant native vegetation across Western Sydney and along the coastal strip of much of NSW, the concept of providing the opportunity

for biodiversity offsets to strengthen conservation of native landscapes and the associated species, provides a compelling argument for the introduction of legislation to mitigate environmental losses. However, the extent of the disquiet associated with such offsets in the US, even after 30 years of development, is of concern. In this paper I reflect on the US experience and discuss some of the pitfalls that should be considered in the on-going implementation of the NSW approach to formalising biodiversity offsets (BioBanking).

The case for new legislation

Australia has 'particularly large numbers' of threatened species (IUCN 2006) and the rate of loss is accelerating, in part, due to expanding urbanisation (Burgen 2008). In NSW the scale of loss has been 'substantial'. Approximately 1,000 species, populations and communities are either endangered or vulnerable (DECC 2006). However, these figures are merely the 'tip of the iceberg' because the status of most invertebrate species, fungi and microbes associated with endemic ecosystems are effectively unknown. This 'other 99%' (Ponder and Lunney 1999) of biota is undoubtedly suffering significant biodiversity loss. For example, in the remnants of urban Sydney, the species abundance and diversity of canopy arthropods differed between large and small remnants with similar vegetation (Hochuli *et al.* 2004). Since there may now be less than 5% of Cumberland Plain Woodland (McManus 2005), a threatened ecological community of Western Sydney, and remnants in this fragmented landscape continue to be eroded and lost (Wotherspoon and Burgen 2010), it can be assumed that there is a continued loss of biodiversity in this rapidly urbanising area.

Overall the major threat to the health, abundance and diversity of these remnant native ecosystems is fragmentation (Burgen and Wotherspoon 2009). A wide range of processes impact on the integrity and long-term viability of ecosystems (Barkmann and Windhorst 2000) including the introduction of species from outside of their normal range (Dickman 1996). In peri-urban environments this may include freshwater turtles (Burgen 2006, 2007), cats (Gibson *et al.* 1994; Short *et al.* 1997) and birds (Catterall 2004; Burgen and Saunders 2007). Managing the associated threats to native species, rehabilitation of degraded areas, and assisting the recovery of threatened species creates major challenges. This is pertinent to the situation in peri-urban Western Sydney where agricultural lands and remnant native vegetation are replaced by large housing estates with small gardens consisting of similar plantings, lawn and hard surface characteristics (Burgen 2004). There is also on-going fragmentation of larger blocks that often results in the loss of habitat (including single trees) that are used by threatened species (e.g., squirrel glider *Petaurus norfolkensis*; grey-headed flying-fox *Pteropus poliocephalus*; eastern freetail-bat *Mormopterus norfolkensis* Cumberland Plain land snail *Meridolum comeovirens*; Wotherspoon and Burgen 2010). This constant erosion of habitat (including degraded habitat) typically leads to a change in the diversity and abundance of native species such as birds (Burgen 2004; Catterall 2004) in the urbanising landscape. Before the BioBanking legislation was introduced in NSW in

2006, there was no formal process to mitigate loss by buying 'offset credits' of even threatened communities, populations or species. However, offsets have been negotiated. For example, in Western Sydney the National Parks and Wildlife Service obtained offsets from the developers of the Australian Defence Industries (ADI) site at St Marys, the largest remnant of the threatened Cumberland Plain Woodland remaining (Wotherspoon and Burgen 2009). On the coast the Roads and Traffic Authority provided 89 ha of land for compensatory habitat to offset losses due to the development of the bypass of the Pacific Highway at Karuah, north of Sydney (DEC 2005). Formalisation of the BioBanking process is expected to increase the number of such offsets approved.

'Tools' to mitigate biodiversity loss

As indicated above, modelled on the concepts of the US wetland mitigation banks (see e.g., DEC 2006), the NSW government introduced the *Threatened Species Conservation Amendment (Biodiversity Banking)* Bill 2006 to add to the suite of legislation to strengthen the conservation of habitats and species through biodiversity offsets. Previous legislation (e.g., *Native Vegetation Act 2003*, *Fisheries Management Act 1994*) also sought to mitigate such losses through offset schemes.

Biodiversity values are defined in the 2006 BioBanking legislation as including '..the composition, structure and function of ecosystems, and includes (but is not limited to) threatened species, populations and ecological communities, and their habitats'. The provisions of the legislation expand opportunities to negotiate mitigation of development activities. The process is based upon voluntary conservation activities that are designed to offset residual, unavoidable damage to biodiversity caused by proposed development activities. It provides incentives to protect biodiversity values by providing private landholders with opportunities for conservation of biodiversity, and ensures security and management of the offsets (DECC 2007).

The motivation for the legislation was to address native vegetation clearing for urbanisation and the impact that such activity has on biodiversity values, including threatened species, in peri-urban Sydney and the coastal ribbon development. If upon assessment clearing is allowed in these areas, landowners may generate 'biodiversity credits' as at least part of their commitment to enhance and protect biodiversity values more broadly. Subsequently these credits may be on-sold to offset the impacts on biodiversity values due to the development. Development may then proceed if the offsets used provide for a 'net maintain or improve outcome' for biodiversity (DECC 2008). Under some circumstances this legislation therefore provides developers and local governments with a voluntary alternative to the current 'assessment of significance' under the *Environmental Planning and Assessment Act 1979*. The 'improve or maintain' concept is therefore now the basis of the BioBanking assessment approach, however development decisions are also required to address additional matters, including social and economic considerations (DECC 2008).

Because the assessment is scale dependent (DECC 2008), the BioBanking approach has the potential to offset biodiversity loss where on-site conservation is difficult or costly to achieve, the typical developments in the landscapes of Western Sydney and coastal areas targeted by the offset legislation. This legislation is seen to strengthen current instruments designed to conserve such habitats and the threatened species that use these remnants. Its major strength is that it enshrines in legislation an additional tool that formalises the process to negotiate with developers and landholders to minimise the impact of their development activities. It was reported (DECC 2007) that offsets are an appropriate mechanism to 'counterbalance' the impacts on biodiversity due to development, and formalises current practice.

Pitfalls to the conservation of biodiversity

Limited scope of the definition of biodiversity

"Biodiversity" is the diversity of life on earth and consists of three components: genetic diversity, species diversity and ecosystem diversity (pp. vii, DPI and DECC 2009). However, the assessment methodology for BioBanking focuses on matters related directly to endangered ecological communities, threatened species and their immediate habitats, and although not explicitly stated in the definition of biodiversity in the *BioBanking Assessment Methodology* (DECC 2008), 'landscape values' that include the 'current and future' condition of vegetation cover within the surrounding 100 and 1,000 ha of the proposed development, the 'value' of the adjacent remnant area, and connectivity. It will be within this context and at this 'coarse grain' that consideration of the full suite of biodiversity will indirectly occur. Other important aspects of biodiversity required for at least the survival of a species include metapopulation considerations, impediments to dispersal (e.g., fragmentation; loss of ecosystem function), population/ecosystem viability and genetic diversity (Burgin 2008). At best, these will also only occur indirectly.

Flaws with the 'improve or maintain' concept

There are also major flaws associated with the offset of natural habitat to mitigate against development. In the US remnant habitat in urban areas tends to be offset by supporting conservation in rural areas (Ruhl and Salzam 2006). Such loss of urban remnants is most acute when the offset is associated with relic habitat, or an endangered species. Frequently the primary reason for their endangerment is the previous removal and/or fragmentation of habitat. The 'improve or maintain' concept implies that the species will be conserved or habitat will be created elsewhere in the landscape or the species range to compensate for the inevitable loss that will occur if land is relinquished for development. This concept of a trade between areas does not necessarily result in such compensation (Carruthers and Paton 2005). However, this is the focus of the NSW market-driven approach. Rural lands can be used to offset urban biodiversity loss via the retirement of credits that at least maintain the

same biodiversity values in the offset area, although there are circumstances (e.g., proposed development sites with high biodiversity values that can not be offset) where this may not be an option (DECC 2008). This approach does not necessarily provide protection for the native species/habitats within the region of proposed development and so the concerns expressed about the US legislation by Carruthers and Paton (2005) remain an issue with the NSW legislation.

Gibbons and Lindenmayer (2007) pointed out that when offset schemes fail to require sites to be improved commensurate with loss invoked by a development, that are switched with sites that have no capacity for improvement, or represent sites that are not under threat of decline, the outcome will be a loss of the endemic ecosystem commensurate with the area cleared. An example of where this has occurred in the US is with the Stillwater Plain Conservation area that has a substantial number of unique wetlands, and the 364.28 ha will be conserved by developing 'credits' for sale to offset loss of wetlands. However, the area was not in danger of loss because it was uneconomic for urban development (Bayon 2002). Trading of an ecosystem under threat with credits on land that is not threatened cannot be considered as a gain for conservation of native habitats. In an equivalent situation in NSW, the offset may involve restoration or other enhancement of the habitat used as an offset (DECC 2007).

Where the offset provides for habitat creation or some other form of compensation other than a 'like for like swap', gains will probably not compensate for the loss to development (Hilderbrand *et al.* 2005). If the offset is achieved through habitat creation, often the case in the US (e.g., NRC 2001; Turner *et al.* 2001; Kihslinger 2008), there will inevitably be a lag between the habitat destruction and replacement with equivalent habitat. In the US, biodiversity offsets frequently fail to compensate for habitat lost (Brown and Veneman 2001). In Australia, Cunningham *et al.* (2007) found that compared to remnant vegetation, after more than 20 years landscapes supplemented with plantings or those developed from plantings, were inferior habitat for at least some animal species. One approach to attempt to compensate for such losses is to obtain a larger area than lost in the development (e.g., Turner *et al.* 2001; Kihslinger 2008), and this is a technique that will be used under the BioBanking approach.

Comparative success with small compared to large remnants

In the US success has been greater with wetland offsets that include large areas. Most of these appear to comply with negotiated requirements. However, large numbers of small scale projects fail (ten Kate *et al.* 2004). The major focus of the NSW BioBanking legislation is on the rapidly urbanising areas of Western Sydney and the coastal strip. Many of these developments will be of small scale (e.g., single urban block, rural-residential development). Many of these sites include habitat for threatened species and pre-BioBanking legislation these have been frequently approved for development, often without offset

for the habitat loss (Wotherspoon and Burgin 2009). Since such habitat is being approved for development currently, the options provided through BioBanking may not prevent such continued loss, at least in the short term. However theoretically there is greater opportunity to support habitat conservation elsewhere to offset such losses. Where such offsets are sought by the developer, amalgamation of credits from a number of small-scale developments would presumably maximise conservation outcomes.

Problems with non-compliance with legislation

Overall the greatest issue with wetland offsets uncovered in the US is the high level of non-compliance (see e.g., reviews by NRC 2001; Turner *et al.* 2001; Kihslinger 2008). It has been demonstrated (e.g., Kentula *et al.* 1992; Brown and Veneman 2001) that wetland mitigation works have not approached 'no net loss' and it has been suggested that even the '40,000 acres conserved' by conservation banking is 'modest' compared to the overall area affected by development. However, even this figure has been challenged. Quoting Julie Sibbing of the US National Wildlife Federation, ten Kate *et al.* (2004) reported that, in addition to the land area of wetland restoration the figures included areas avoided by the projects, preservation of existing wetlands and/or upland buffers around wetlands. It was further suggested that the US Army Corps of Engineers, the overseers of the wetland developments, have failed to keep adequate records to enable the assessment of whether 'no net loss' has been achieved (Kentula *et al.* 1992), to the point that Trott (2001) suggested that there was 'a complete lack of respect' for the country's natural resources. Since BioBanking commenced in New South Wales in July 2008, and the *Compliance Assurance Strategy* was only published in July 2008, compliance measures outlined in the Strategy (DECC 2008) are yet to be tested. However there are clear indications that compliance has been carefully considered. For example, the information contained in the BioBanking registers will be available for public inspection, local authorities (e.g., Catchment Management Authorities, local government) will be involved in the process, and the Department of Environment and Climate Change is committed to a review of operation after two years.

Mitigating unavoidable harm?

Under the BioBanking legislation, there is no requirement to justify that impacts are unavoidable. The key test for allowing an offset to occur depends on the development impacts on 'red flag' areas (i.e., '...areas at the development site with high biodiversity conservation values..[which].. cannot be offset by retirement of biodiversity credits in order to improve or maintain biodiversity values...'; DECC 2008). Generally if the 'improve or maintain test' is not met in its proposed form, the development will not be allowed to proceed even when offsets have been proposed. If the development is approved the offsets will be established in the BioBanking assessment process and will address such principles as 'like for like' (DECC 2008). However, even in the US where the

concept of wetland mitigation is most well developed, the outcomes frequently fall short of 'like for like' (see Brown and Veneman 2001; Turner *et al.* 2001) and mitigating 'unavoidable harm' has led to the creation of a major industry based on an environmental currency. This has led to a variety of businesses specialising in enhancing biodiversity in order to sell credits (Bayon 2002). Despite their popularity, Stokstad (2008) alleged that the current US legislation pushes the limits of scientific knowledge. One approach to reduce this problem is to evoke the precautionary principle with the aim of maintaining the conservation goal of 'like for like' offsets.

The way forward

The outcomes of wetland mitigation offsets in the US have resulted in urban wetlands being lost to development and the replacement offset being developed in rural areas (Ruhl and Salzam 2006). Because the New South Wales BioBanking scheme also has a market focus (DECC 2007), the outcomes are likely to be equivalent. However in urban areas, there is substantial land that is not currently considered for conservation. This would provide opportunities for offsets within the same landscape as the remnant habitat is lost to development, and ensure that these (frequently) highly degraded lands are restored and retained as high quality ecosystems for biodiversity in perpetuity. These are the excess lands associated with, for example, golf courses and other sporting fields, parkland, flood prone lands that are unsuitable for development, educational institutions, cemeteries, showgrounds, railway reserves, unproductive agricultural land on developed properties, and roadside verges. There may also be similar opportunities on undeveloped land in private ownership. Funds could be provided by the developer to have such areas restored and maintained as habitat within the local landscape as an alternative to trading credits for land outside of the urban area and thus continuing to erode the native biodiversity associated with urban areas. However with the current focus on a market-based mechanism (DECC 2007), it will be prudent for developers to seek 'cheaper' options outside of urban areas (pers. comm., anon. reviewer) and the urban degraded lands will tend not to be incorporated into the Scheme.

Conclusions

Biodiversity loss is of on-going concern, however the concept of 'no net loss' generally remains a nebulous outcome. Associated scientific and management issues are yet to be resolved, although there is some evidence that in the US wetland offsets of larger size are more likely to be successful than smaller ones (e.g., Brown and Veneman 2001). However, even if the correct decisions are made in determining biodiversity offsets, the best outcome appears to be a slowing of biodiversity decline overall but potentially a greater loss within the urbanising areas. To minimise the loss of biodiversity due to offsets, there is an urgent need to learn from previous practice. Based on the US experience, it would appear that this is largely associated with factors of compliance, long term monitoring and management of offset ecosystems. This

issue has been addressed in the NSW approach to offsets, and it is suggested that the current compliance assurance mechanisms will provide for the identification of non-compliance in 'a timely manner and [they will be] dealt with using a consistent, fair and equitable approach' (pp. 2, DECC 2008). Part of this approach will be to support catchment management authorities, consent authorities and accredited persons associated with the scheme's implementation through a 'help desk' service, information material and training. The registers (agreement, statement and credits registers) will also be available for 'public inspection'. Monitoring compliance will be provided 'through public notification, monitoring and record-keeping by Biobank site owners' while inspections and investigations will be conducted by the Department of Environment and Climate Change, other agencies, and via the lead agency's (DECC) compliance audit programs (DECC 2008). This may ensure that compliance occurs in the offset areas but since these are likely to be outside

of the immediate area of development, the process will do little to conserve biodiversity in the urbanising areas.

The outcomes for biodiversity conservation could be improved with better developed theories and practice in associated disciplines (Burgin 2008). However there does not appear to be a mechanism for research into the long-term management of offset sites to enable the development of better techniques, and the testing of hypotheses that will provide for more rapid theory development of the associated immature sciences (e.g., restoration science, landscape management, restoration ecology) that are needed to maximise outcomes. In the implementation of BioBanking offsets legislation in New South Wales there is the opportunity to learn from the errors of others while refining and developing the science to underpin biodiversity conservation. Some of these lessons appear to have been learnt, however, much more could have been achieved to support the long-term viability of the region's biodiversity.

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